0031

ANDALEX
RESOURCES, INC.
Tower Division

P.O. BOX 902
PRICE, UTAH 84501
PHONE (801) 637-5385
TELECOPIER (801) 637-8860

July 14, 1998

Ms. Pamela Grubaugh-Littig
Utah Coal Program
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

ACT/015/032 #2
Copy Dave (all)

Dear Pam:

Enclosed is a draft version of a proposed revision for the GENWAL Resources, Inc. mining and reclamation plan. The proposed changes include the addition of several new monitoring points to the water monitoring plan. Please note that this is not being submitted as a revision at this time. When I spoke with Dave Darby today he indicated that he could review the proposed monitoring locations in a draft format. Please call me if you have any questions.

Sincerely,

Jean Semborski

Jean Semborski
Environmental Coordinator

DRAFT

Monitoring Plan

Genwal Resources, Inc
Crandall Canyon Mine

The hydrologic monitoring program is designed to provide data to assist in determining whether mining activities impact surface water or groundwater resources in the lease area. The selected spring, spring, and well monitoring locations are distributed spatially throughout the lease area. Additionally, springs have been chosen for monitoring from each of the geologic formations present in the lease area. The proposed monitoring program for wells, springs, and streams in the Genwal lease area is shown in Figure 1 and is summarized in Tables 1, 2, 3, and 4, and is described below.

Springs

The proposed spring monitoring program is designed to provide verification that

1. Groundwater systems in the formations overlying mined areas operate independently of Blackhawk Formation groundwater systems in the mine,

2. The temporal variability of spring discharges are due to climatic variability (i.e. wet and dry years), and

3. Mining is not affecting groundwater systems in overlying formations.

The spring monitoring locations have been chosen to provide information from each geologic formation which could potentially be impacted by mining operations. Additionally, springs and creeks in the vicinity of the Joes Valley Fault system have been selected for monitoring. No spring monitoring locations from the Flagstaff Limestone are recommended because no springs were identified in the small area of Flagstaff Limestone exposure which are suitable for long term monitoring (i.e. they have very small flows and are ephemeral in nature). The Star Point Sandstone crops out only in the extreme eastern portion of the existing lease area (miles away from active mining areas) and does not crop out in the Mill Fork Tract area. For these reasons, no new spring locations in the Star Point Sandstone are recommended for monitoring.

North Horn Formation

We recommend that six springs from the North Horn Formation be monitored for discharge and solute chemistry. These springs include SP1-22, SP1-19, and SP2-9 which have previously been monitored, and springs RR-21, RR-28, and UJV-100a, which are

new monitoring locations on the Mill Fork Tract. It has been demonstrated (Mayo and Associates, 1998, 1997) that the groundwater systems in the North Horn Formation are generally shallow, local type systems which are not in hydraulic communication with the groundwater systems encountered in the mine. It has also been demonstrated that the possibility of mining related subsidence fractures intercepting flow to North Horn Formation springs is low. Therefore, no detrimental impacts to the flow or solute chemistry of springs in the North Horn Formation are anticipated. To document the responses of these springs to long-term fluctuations in climate, and to verify that subsidence fractures do not adversely impact spring flows, we recommend that these springs be regularly monitored.

Price River Formation

We recommend that six springs from the Price River Formation be monitored for discharge and solute chemistry. These springs include SP1-3, SP2-14, SP2-23, and SP2-24, which have historically been monitored as part of the existing lease, and springs EM-213, and MF-20 which are new monitoring locations on the Mill Fork Tract. Like springs discharging from the North Horn Formation, detrimental impacts to the flow or solute chemistry of Price River Formation springs are not anticipated. To document that the observed fluctuations in spring discharge rates are due to long-term climatic fluctuations, and that mining operations have not impacted these springs, we recommend that these springs be monitored regularly.

Castlegate Sandstone

We recommend that four springs from the Castlegate Sandstone be monitored for discharge and solute chemistry. These springs include SP-47a, which has been monitored as part of the existing lease, and springs UJV-208, UJV-151, and UJV-152, which are new monitoring locations in the Mill Fork Tract. Historical monitoring data from SP-47a demonstrate that mining activities near this spring have not had any detrimental impact on solute chemistry or flow rates. Detrimental effects on the Castlegate Sandstone springs in the Mill Fork Tract are not anticipated. We recommend monitoring of these sites to verify that there are no mining-related impacts to these springs.

Blackhawk Formation

We recommend that springs SP-30, SP-36 and SP-58 from the Blackhawk Formation be monitored for flow and solute chemical composition. Each of these springs have been monitored historically as part of the Genwal monitoring program. Spring SP-58 is located in the existing lease area near the northern boundary of the Mill Fork Tract. Unstable isotopic data from SP-58 indicate that this spring discharges modern water (<50 years old) which is not related to the groundwater encountered in the mine. It is anticipated that springs SP-30 and SP-36 also discharge modern water. Therefore, impacts to these springs resulting from mining operations are not anticipated, nor have they been observed. We recommend continued monitoring of these sites to provide verification that the variations in the discharge rates from these springs are due to long-term fluctuations in climate.

Joes Valley Fault System

We recommend that two springs discharging in the vicinity of the surface trace of the Joes Valley Fault system on the Mill Fork Tract be monitored. These springs, UJV-151 and UJV-152, are also monitored as part of the Castlegate Sandstone monitoring. Unstable isotopic information from these two springs indicates that they are discharging modern water (<50 years) which is not related to the fault system. No springs discharging at the surface in the vicinity of the fault system contain an old component of water which could be coming from the fault system. Likewise, groundwater discharging in upper Joes Valley west of the fault system contains abundant tritium, suggesting a modern origin. This suggests that the fault system is not leaking appreciable amounts of water at the surface. However, to confirm that mining in the vicinity of the fault system will not impact groundwater near the surface, we recommend that these two springs be monitored for flow and solute chemistry. Additionally, two sites on Indian Creek are recommended for regular monitoring. The new site on Indian Creek immediately south of the lease boundary monitors the combined discharge from the western slope of East Mountain, Upper Joes Valley, and any discharge which may be occurring from the Joes Valley Fault system. If significant discharge from the fault system were occurring, and if this discharge were impacted by mining operations, the impact could be identified through monitoring of Indian Creek.

Streams

We recommend the regular monitoring of six stream locations. These locations are discussed below.

Indian Creek-1

This monitoring station is located immediately south of the Indian Creek campground. Discharge at this site includes drainage of the west slope of East Mountain and Upper Joes Valley. This is an established monitoring location. It is recommended that this site continue to be monitored regularly for flow and solute chemistry.

Indian Creek-2

It is recommended that an additional monitoring station be established on Indian Creek immediately south of the Mill Fork Tract lease boundary. Discharge at this location represents the total discharge from the west slope of East Mountain, upper Joes Valley, and any potential discharge from the Joes Valley Fault system on both the existing lease and the Mill Fork Tract. Any major diminution of flow in these areas resulting from mining operations can be detected through monitoring of this station. Regular measurements of both flow and solute chemistry are recommended.

Horse Canyon Creek

Monitoring of Horse Canyon Creek is currently part of the Genwal monitoring program. However, most of the area contained in the Horse Canyon Creek drainage is located north of the existing lease and mining in this area has ceased. We recommend that monitoring of this location continue only until a partial lease relinquishment is obtained

from the U.S. Forest Service and the Utah Division of Oil, Gas and Mining. Monitoring at this location is for both flow and solute chemistry.

Blind Canyon Creek
Blind Canyon Creek drains much of the eastern half of the existing Genwal lease area. This station is currently monitored for both flow and solute chemistry as part of the existing monitoring plan. We recommend that monitoring of this location continue only until a partial lease relinquishment is obtained from the U.S. Forest Service and the Utah Division of Oil, Gas and Mining. Monitoring at this location is for both flow and solute chemistry.

Crandall Creek (upper and lower flumes)
Genwal currently monitors both flow and solute chemistry on Crandall Creek at the upper and lower flumes. The upper flume is located immediately upstream of the mine surface facilities. The lower flume is located downstream of the mine facilities and contains the mine discharge water. Comparison of upper flume and lower flume data facilitates the determination of the cumulative impact of the surface facilities and mine discharge water on Crandall Creek. Continuing monitoring of these two sites is recommended.

Monitoring Wells
Genwal is currently monitoring six wells in the Star Point Sandstone. These wells include MW-1, MW-2, MW-6, MW-6a, MW-7, and MW-8. MW-1 is completed in the Spring Canyon member of the Star Point Sandstone and is a water supply well for the Crandall Canyon Mine surface facilities. Wells MW-2, MW-6a, and MW-8 are monitoring wells completed in the Spring Canyon member. MW-6a is a monitoring well completed in the Panther member of the Spring Canyon Sandstone. MW-7 is a monitoring well completed in the Spring Canyon member within a few hundred feet of the Joes Valley Fault system. We recommend that these wells be monitored regularly for water level and water quality field parameters.

Chemical Parameters
The recommended list of water quality analytical parameters for operational monitoring of springs and streams is given in Tables 3 and 4. It has been demonstrated that the iron and manganese concentrations in waters from springs and creeks is extremely small. Historically, the springs and streams monitored in the lease area have never exceeded water quality standards for iron and manganese. Because the potential for elevated concentrations of these constituents is remote, we recommend that these parameters be monitored only once per year. Because the potential for elevated concentrations of these constituents is greatest during the low flow periods, we recommend that the monitoring for these parameters occur in the third quarter.

Table 1 Recommended monitoring program

Monitoring Wells	Protocol	Comments
MW-1	A,3	Spring Canyon member of Star Point Sandstone, water supply well for mine
MW-2	A,3	Spring Canyon member of Star Point Sandstone
MW-6	A,3	Panther member of Star Point Sandstone
MW-6a	A,3	Spring Canyon member of Star Point Sandstone
MW-7	A,3	Spring Canyon member of Star Point Sandstone
MW-8	A,3	Spring Canyon member of Star Point Sandstone
Streams		
Cottonwood Creek Drainage		
Indian Creek-1	B,1	Existing location on Indian Creek
Indian Creek-2	B,1	New location on Indian Creek below lease boundary
Huntington Creek Drainage		
Crandall Canyon u. flume	B,1	Existing location on Crandall Creek above mine site
Crandall Canyon l. flume	B,1	Existing location on Crandall Creek below mine site
Horse Canyon Creek	B,1	Existing location, discontinue monitoring after lease relinquishment
Blind Canyon Creek	B,1	Existing location, discontinue monitoring after lease relinquishment

Table 1 Recommended monitoring program (continued)

Springs	Protocol	Comments
SP1-22	C,2	North Horn Formation (existing location)
SP1-19	C,2	North Horn Formation (existing location)
SP2-9	C,2	North Horn Formation (existing location, discontinue monitoring after lease relinquishment)
RR-21	C,2	North Horn Formation (new location)
RR-28	C,2	North Horn Formation (new location)
UJV-100A	C,2	North Horn Formation (new location)
SP1-3	C,2	Price River Formation (existing location)
SP2-14	C,2	Price River Formation (existing location, discontinue monitoring after lease relinquishment)
SP2-23	C,2	Price River Formation (existing location)
SP2-24	C,2	Price River Formation (existing location)
EM-213	C,2	Price River Formation (new location)
MF-20	C,2	Price River Formation (new location)
SP-47a	C,2	Castlegate Sandstone (existing location, discontinue monitoring after lease relinquishment)
UJV-208	C,2	Castlegate Sandstone (new location)
UJV-151	C,2	Castlegate Sandstone (new location near J.V. Fault trace)
UJV-152	C,2	Castlegate Sandstone (new location near J.V. Fault trace)
SP-30	C,2	Blackhawk Formation (existing location)
SP-36	C,2	Blackhawk Formation (existing location)
SP-58	C,2	Blackhawk Formation (existing location)
UPDES		
UPDES 001	D,4	Sediment pond
UPDES 002	D,4	Mine water discharge

Table 2 Field and laboratory measurement protocol

Water level and flow measurements

A Monitoring well: quarterly water level measurements

B Stream: quarterly discharge measurements

C Spring: quarterly discharge measurements

D UPDES: flow measurements as stipulated in the UPDES permit

Water Quality

1 Stream: quarterly water quality operational laboratory measurements

2 Spring: quarterly water quality operational laboratory measurements

3 Monitoring well: quarterly water quality field parameter measurements

4 UPDES: water quality measurements as stipulated in the UPDES permit

Table 3 Recommended groundwater operational water quality monitoring

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µs/cm @ 25°C
Temperature	°C

LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg L^{-1}
Carbonate	mg L^{-1}
Bicarbonate	mg L^{-1}
Calcium (dissolved)	mg L^{-1}
Chloride	mg L^{-1}
Iron (dissolved)	mg L^{-1} (3rd quarter only)
Iron (total)	mg L^{-1} (3rd quarter only)
Magnesium (dissolved)	mg L^{-1}
Manganese (dissolved)	mg L^{-1} (3rd quarter only)
Manganese (total)	mg L^{-1} (3rd quarter only)
Potassium (dissolved)	mg L^{-1}
Sodium (dissolved)	mg L^{-1}
Sulfate	mg L^{-1}
Cations	meq L^{-1}
Anions	meq L^{-1}

Table 4 Recommended surface water operational water quality monitoring

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µs/cm @ 25°C
Dissolved Oxygen	mg L^{-1}
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg L^{-1}
Carbonate	mg L^{-1}
Bicarbonate	mg L^{-1}
Calcium (dissolved)	mg L^{-1}
Chloride	mg L^{-1}
Iron (dissolved)	mg L^{-1} (3rd quarter only)
Iron (total)	mg L^{-1} (3rd quarter only)
Magnesium (dissolved)	mg L^{-1}
Manganese (dissolved)	mg L^{-1} (3rd quarter only)
Manganese (total)	mg L^{-1} (3rd quarter only)
Potassium (dissolved)	mg L^{-1}
Sodium (dissolved)	mg L^{-1}
Sulfate	mg L^{-1}
Oil and grease	mg L^{-1}
Cations	meq L^{-1}
Anions	meq L^{-1}

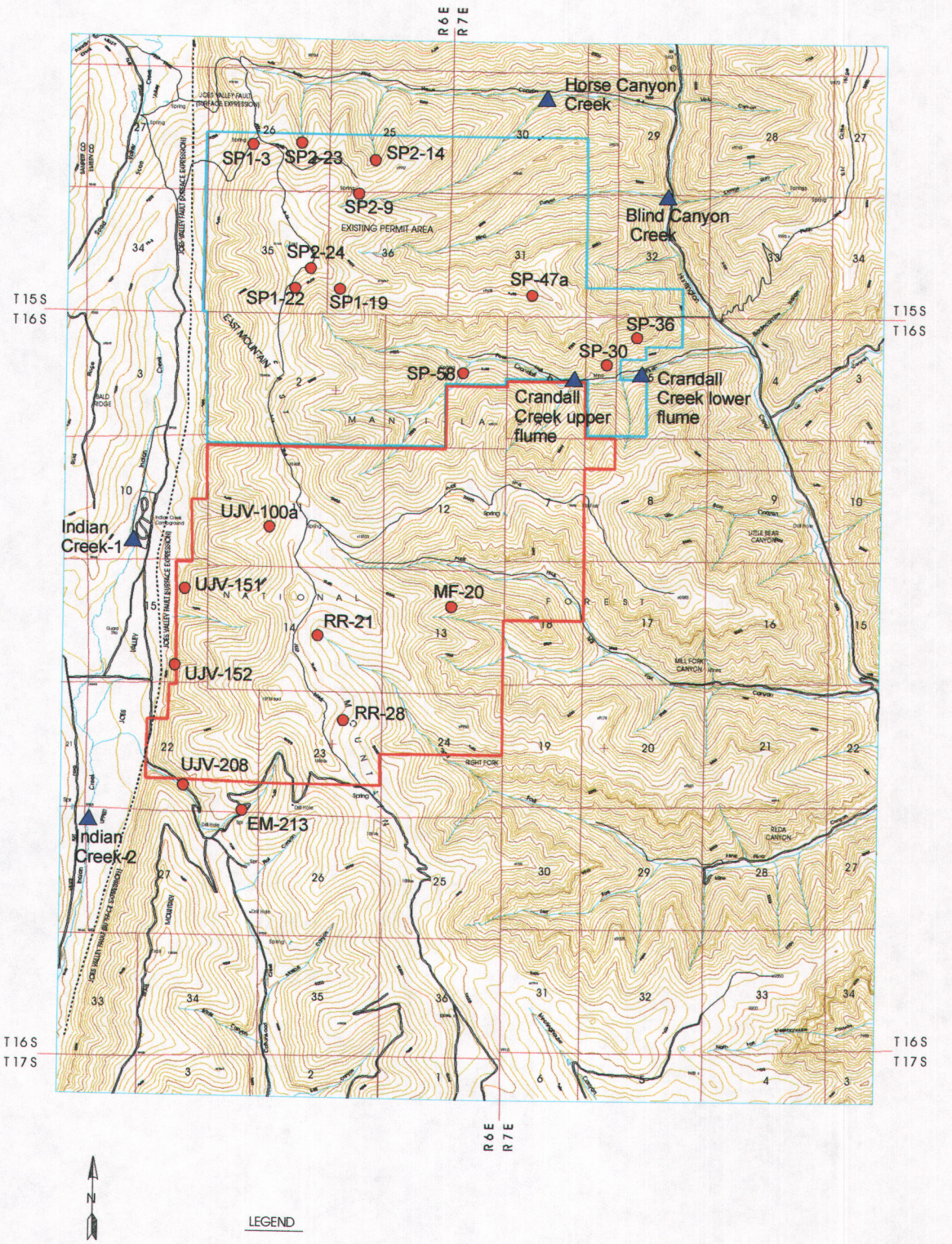

Figure 1 Hydrologic monitoring locations